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NATIONAL DAM SAFETY PROGRAM. LEO JOURNAGAN LAKE (MO 20395), OSA--ETC(U)
AUG 79 J M HEALY, S L BRADY, N MORALES DACW43-79-C-0070
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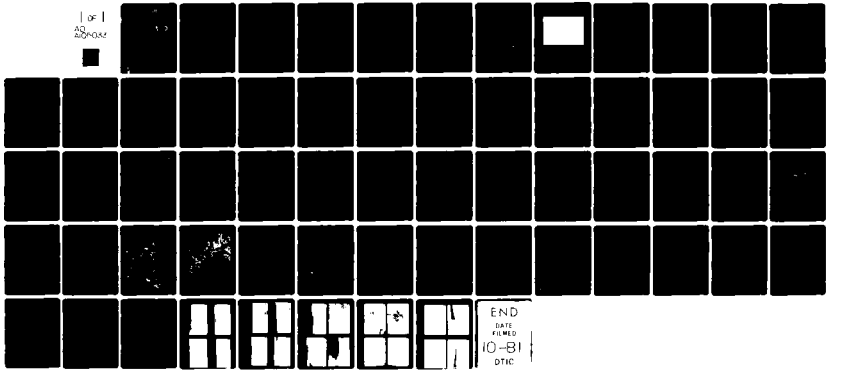

LEVEL II

OSAGE - GASCONADE BASIN

LEO JOURNAGAN LAKE

GREENE COUNTY, MISSOURI

MO 20395

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

AUGUST 1979

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John M. /Healy
Steven L. /Brady
Nelson /Morales
Tom /Beckley

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Leo Journagan Lake Dam, MO. 20395

This report presents the results of field inspection and evaluation of the Leo Journagan Lake Dam. It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division
14 SEP 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer
14 SEP 1979
Date

LEO JOURNAGAN LAKE

GREENE COUNTY, MISSOURI

MISSOURI INVENTORY NO. 20395

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared by

Anderson Engineering, Inc. Springfield, Missouri
Hanson Engineers, Inc., Springfield, Illinois

Under Direction of

St. Louis District, Corps of Engineers

For

Governor of Missouri

August, 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Leo Journagan Lake
State Located:	Missouri
County Located:	Greene County
Stream:	Tributary to James River
Date of Inspection:	16 May 1979

Leo Journagan Lake was inspected by an interdisciplinary team of engineers from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and they have been developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, the St. Louis District, Corps of Engineers has determined that this dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur if the dam fails. The estimated damage zone extends approximately 1 mile downstream of the dam. Located within this zone are 3 dwellings and 1 improved road crossing. The dam is in the small size classification, since the maximum storage capacity is greater than 50 acre-feet but less than 1000 acre-feet.

Our inspection and evaluation indicates that the combined spillways do meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The combined spillways will pass 82 percent of the Probable Maximum Flood without overtopping. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The guidelines require that a dam of small size with a high downstream hazard potential pass 50 to 100 per-

cent of the PMF. Considering the small volume of water impounded, and the height of the dam, 50 percent of the PMF has been determined to be the appropriate spillway design flood. The 100-year frequency flood will not overtop the dam. The 100-year flood is one that has a 1 percent chance of being exceeded in any given year.

The embankment and appurtenances inspected appear to be in good condition. However, the unlined emergency spillway could be a problem if the lake were filled to normal level. No sloughing was noted and very minimal surface erosion was present on the embankment. Other deficiences noted were the lack of seepage and stability analysis records.

It is recommended that the owners take the necessary action in the near future to correct the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.

John M. Healy, P.E
Hanson Engineers, Inc.

Steven L. Brady, P.E.
Anderson Engineering, Inc.

Nelson Morales, P.E.
Hanson Engineers, Inc.

Tom Beckley, P.E.
Anderson Engineering, Inc.

OVERVIEW OF DAM AND LAKE

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

LEO JOURNAGAN LAKE - ID No. 20395

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APPENDICES

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

A. Authority:

The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection be made of Leo Journagan Lake in Greene County, Missouri.

B. Purpose of Inspection:

The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and a visual inspection in order to determine if the dam poses hazards to human life or property.

C. Evaluation Criteria:

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief Engineers, "Recommended Guidelines for Safety Inspection of Dams, Appendix D." These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT:

A. Description of Dam and Appurtenances:

Leo Journagan Lake Dam is an earth fill structure approximately 20 ft. high and 1100 ft. long at the crest. The appurtenant works consist of a 6 1/4 inch diameter primary spillway discharge pipe, a 4 inch diameter pipe with gate valve that is used for drawing the lake level down and a grass lined emergency spillway on the east abutment. Sheet 3 of Appendix A shows a plan and profile of the embankment and spillways and a typical section of the embankment. Sheet 4 of Appendix A shows a detail of the drawdown valve pit.

B. Location:

The dam is located in the southeast part of Greene County, Missouri on a tributary of the James River. The dam and lake are within the Galloway, Missouri 7.5 minute quadrangle sheet (Section 7, T28N, R20W - latitude 37°8.5'; longitude 93° 9.5'). Sheet 2 of Appendix A shows the general vicinity and Sheet 1 of Appendix A shows the location within the state.

C. Size Classification:

With an embankment height of 20 ft. and a maximum storage capacity of approximately 223 acre-ft., the dam is in the small size category.

D. Hazard Classification:

The St. Louis District, Corps of Engineers has classified this dam as a high hazard dam. The estimated damage zone extends approximately 1 mile downstream of the dam. Located within the damage zone are 3 dwellings and 1 improved road crossing. The upper flood plain is broad and grass covered.

E. Ownership:

The dam is owned by Leo Journagan. The owner's address is 3524 Whitehall, Springfield, Missouri. Home telephone number is 417-883-1487.

F. Purpose of the Dam:

The dam was constructed primarily for watering cattle and erosion control.

G. Design and Construction History:

A design was performed by the United States Dept. of Agriculture, Soil Conservation Services (SCS) in August of 1974. The dam was constructed during late 1974 and early 1975 according to the Journagan family. Plans for the construction are available from the Greene County, Missouri, office of the SCS at 3003 E. Trafficway in Springfield, MO. A set is included in Appendix A of this report. The dam was constructed by Mr. Leo Journagan and no construction records exist. During the construction of the embankment a sinkhole collapse occurred in the upper part of the lake. The sink

was inspected by John Whitfield of the Office of State Geologist and a letter report issued. A copy of this report is included as Sheet 4 of Appendix B. The embankment material was obtained from the lake area. Limestone pinnacles were uncovered in the upper portions of the lake during borrow operations. According to Allen Journagan, the lake has never filled and the water is apparently leaking out in the sink and pinnacle area.

The SCS design sheet (Sheet 5 of Appendix A) shows a core trench. A four-inch dewatering pipe and valve were added to the embankment as those were not indicated on the design sheet. No significant problems in regards to seepage or stability of the embankment are known to have occurred. To our knowledge, no modifications have been made since the original construction.

H. Normal Operative Procedures:

Normal flows are to be passed by the 6 1/4 inch steel pipe spillway which is located at sta. 3 + 67. A grass covered emergency spillway would come into operation for flows that exceeded the capacity of the 6 1/4" steel pipe. Information furnished by the owner indicates neither spillway has been used.

1.3 PERTINENT DATA:

Pertinent data about the dam, appurtenant works, and reservoir are presented in the following paragraphs. Sheet 3 of Appendix A presents a plan, profile and typical section of the embankment.

A. Drainage Area:

The drainage area for this dam, as obtained from the U.S.G.S. quad sheet, is approximately 140 acres.

B. Discharge at Dam Site:

(1) All discharge at the dam site is through uncontrolled spillways.

(2) Estimated Total Spillway Capacity at Maximum Pool (Top of Dam - El. 104): 987 cfs

(3) Estimated Capacity of Primary Spillway: 2.4 cfs

(4) Estimated Experienced Maximum Flood at Dam Site: Unknown (Lake has never filled)

(5) Diversion Tunnel Low Pool Outlet at Pool Elevation: Not Applicable

(6) Diversion Tunnel Outlet at Pool Elevation: Not Applicable

(7) Gated Spillway Capacity at Pool Elevation: Not Applicable

(8) Gated Spillway Capacity at Maximum Pool Elevation: Not Applicable

C. Elevations:

(1) Top of Dam (Measured): West end 103.2; middle 104.6; east end 103.6. Top of dam (plan for construction) 104.0.

(2) Principal Spillway Crest: Plans for construction 53.7 (assumed - bench mark 100.0 for all other measurements)

(3) Emergency Spillway Crest: Plans for construction 100.8 measured 100.5.

(4) Principal Outlet Pipe Invert: Plans for construction 85.3, measured 85.3.

(5) Streambed at Centerline of Dam: Plans for construction 84.3, measured 84.3.

(6) Pool on Date of Inspection: measured 91.83.

(7) High Water Mark: Observed on date of inspection 93.0.

(8) Maximum Tailwater: Unknown

(9) Upstream Portal Invert Diversion Tunnel: Not Applicable

(10) Downstream Portal Invert Diversion Tunnel: Not Applicable

D. Reservoir Lengths:

(1) At Top of Dam: 2000 Feet

(2) At Principal Spillway Crest: 1900 Feet

(3) At Emergency Spillway Crest: 1910 Feet

E. Storage Capacities:

(1) At Principal Spillway Crest: 112 Acre-Feet

(2) At Top of Dam: 223 Acre-Feet

(3) At Emergency Spillway Crest: 126 Acre-Feet

F. Reservoir Surface Areas:

(1) At Principal Spillway Crest: 21 Acres

(2) At Top of Dam: 35 Acres

(3) At Emergency Spillway Crest: 23 Acres

G. Dam:

(1) Type: Rolled earth

(2) Length at Crest: 1100 Feet

(3) Height: 20 Feet

(4) Top Width: 18 Feet

(5) Side Slopes: Upstream 5H:IV; Downstream 5H:IV

(6) Zoning: Homogeneous

(7) Impervious Core: Unknown

(8) Cutoff: Shallow core trench. Design drawing, Sheet 5 of Appendix A shows a core trench with a 10 foot bottom width and 1H:IV side slopes.

(9) Grout Curtain: Unknown

H. Diversion and Regulating Tunnel:

(1) Type: None

(2) Length: None

(3) Closure: None

(4) Access: None

(5) Regulating Facilities: None

I. Spillway:

I.1 Principal Spillway:

(1) Location: West end of dam at sta. 3 + 67.

(2) Type: 6 1/4 inch I.D. smooth steel pipe through dam.

I.2 Emergency Spillway:

(1) Location: East abutment

(2) Type: Grass covered earth with 200 foot crest length and irregular side slopes.

J. Regulating Outlets:

A dewatering pipe was found at the downstream toe of the embankment at sta. 3 + 86. The four-inch I.D. steel pipe comes out of a 24 inch diameter CMP valve pit covered with a steel lid. The valve is a gate valve and the control wheel is located 18 inches below the top of the pit. At the time of the inspection the valve pit was filled with silty soil. The four-inch pipe was not seen on the upstream side, therefore, it must be below the lake level, elevation 91.83, at the time of inspection. A detail of the dewatering valve pit is included on Sheet 4 of Appendix A.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

Design notes and a design cross section of the embankment are available from the Dept. of Agriculture Soil Conservation Service Office at 3003 E. Trafficway, Springfield, MO. Copies of these design notes which include hydraulic calculations are included in Appendix A as Sheets 5 thru 7. No documentation of construction inspection records have been obtained. There are no documented maintenance and operation data to our knowledge.

A. Surveys:

No information regarding pre-construction surveys was able to be obtained. Sheet 3 of Appendix A presents information about the benchmark which was used for the inspection survey.

B. Geology and Subsurface Materials:

The topography around the site is gently rolling to hilly. This area is at the junction of the Western Plains and the Ozarks regions of the state. The soils on the site are residual from cherty limestone. Generally the soil profile consists of a brown silty, friable, clay up to 24 ins. thick followed by a cherty reddish-brown silty clay. These soils are normally followed by reddish-brown to brick red silty clay of high plasticity. The brown silty clays have moderately slow permeabilities while the red silty clays often possess a blocky structure which are often quite permeable. Weathered ledge rock is often found near the surface in this area. The underlying rock is of the Burlington formation of the Osagean Series of the Mississippian Systems. The Burlington formation is a white to light buff, very coarsely crystalline, fossiliferrous, crinoidal limestone. Layers of chert nodules are common in the upper portions of this formation. This bedrock has often weathered unevenly leaving pinnacles, mushroom-like knobs projecting from the rock surface. The crevices between these knobs are filled with the red, often highly plastic, silty clay.

Sinkholes are very prevalent in these geologic conditions. Several sinkholes are shown on the Galloway 7 1/2' quad sheet around this area. A sinkhole developed in the upper reaches of the lake. An inspection report by John W.

Whitfield of the Office of State Geologist discusses this problem and is included as Sheet 4 of Appendix B.

Geologic mapping of Green County, Missouri, compiled by Kenneth C. Thomson of Southwest Missouri State University, shows two fault zones near this site. The Kinser Bridge fault runs generally east and west and lies approximately 1/2 mile to the north of the dam site. The Pierson Creek faults run northwest and southeasterly and the nearest portion of this fault is approximately 1 mile north of the dam site. The Department of Natural Resources has indicated that the faults in this area are generally considered to be inactive and have been for several hundred million years (rock associated with the Mississippian period is approximately 300 million years old). Additional mapping by Mr. Thomson indicates the nearest cave is approximately 1 mile from the dam site.

C. Foundation and Embankment Design:

The Soil Conservation Service designed an embankment cross section which is shown on Sheet 5 of Appendix A. No other foundation or embankment design information was available. Information from the owner indicates that the dam is composed of silty clay soils from the lake area. There is apparently no particular zoning of the embankment and no internal drainage features are known to exist. No construction inspection test results have been obtained.

D. Hydrology and Hydraulics:

The original hydraulic and hydrologic design data has been obtained from the Soil Conservation Service and are presented on Sheets 7 and 8 of Appendix C. Based on a field check of spillway dimensions, embankment elevations, and a check of the drainage area on U.S.G.S. quad sheets, hydrologic analysis using U.S. Army Corps of Engineers guidelines were performed and appear in Appendix C, Sheets 1 thru 7. It was concluded that the structure will pass 82 percent of the Probable Maximum Flood without overtopping. The 100-year frequency flood will not overtop the dam.

E. Structure:

There are no appurtenant structures, other than the drawdown pipe, associated with the dam.

2.2 CONSTRUCTION:

No construction inspection data have been obtained.

2.3 OPERATION AND MAINTENANCE:

No operation and maintenance records were available. Inspection indicates that maintenance of the dam (mowing the grass and brush removal) is done periodically.

2.4 EVALUATION:

A. Availability:

The engineering data available are as listed in Section 2.1.

B. Adequacy:

The engineering data available were inadequate to make a detailed assessment of the design, construction, and operation. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

C. Validity:

The design sheets prepared by the Soil Conservation Service and included in Appendices A and B are valid engineering data on the design of the dam.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

A. General:

The field inspection was made on 16 May 1979. The inspection team consisted of personnel from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The team members were:

Tom Beckley P.E.- Anderson Engineering, Inc. (Civil Engineer)
Steve Brady P.E.- Anderson Engineering, Inc. (Civil Engineer)
Jack Healy P.E.-Hanson Engineers, Inc.(Geotechnical Engineer)
Nelson Morales P.E.- Hanson Engineers, Inc. (Hydrologic and Hydraulic Engineer)

B. Dam:

The dam is an earth fill embankment. Borrow material was apparently obtained from the reservoir area. Based on available surficial soil information for the area, the fill material would be expected to consist of low to medium plasticity cherty silty clays.

The embankment is grass-covered and appears to be in good condition. No sloughing of the embankment or seepage through the embankment was evident. No animal burrows were noted. There was only minimal erosion of the embankment. The embankment was covered with a good grass cover.

No seepage was evident on the embankment, at the top or at the contact of the embankment and abutment.

The horizontal alignment was good. No surface cracking or unusual movement was observed. The absence of riprap has allowed some erosion of the upstream face of the dam.

No instrumentation (monuments, piezometers, etc.) was observed.

C. Appurtenant Structures:

C.1 Primary Spillway:

The 6 1/4" primary spillway pipe was in good condition. The invert was clear, however no provision exists to prevent

the pipe from becoming clogged with debris. At this time this does not present a problem because the primary spillway is not being used due to the low water level.

The outlet of the 6 1/4 inch pipe was also in good condition. No water was noted in the pipe or at its contact with the embankment.

The plunge pool is grass covered and has not been used. The outlet channel is blocked by an 18 inch high wall of field (chert) stones stacked at the base of a fence that runs between the toe of the dam and the county road immediately to the south of the dam.

C.2 Emergency Spillway:

The emergency spillway is unlined, however it is in good condition. There was no brush or weed growth in the spillway area.

D. Reservoir:

The immediate periphery of the lake was grass covered with gentle rolling slopes. The reservoir banks were generally in good condition. There were three small areas of erosion of the bank at the upper reach of the lake. The erosion was caused by surface water flow into the lake.

E. Downstream Channel:

The channel is broad farmland covered with grass and grain. (Refer to pictures 17, 18 and 20.)

3.2 EVALUATION:

If the unlined, unprotected emergency spillway is used, then considerable erosion of the spillway could occur. The spillway should be modified to guard against erosion.

Because the valve of the lake basin is located on the downstream side of the dam, the full head of water impounded by the dam is acting entirely through the dam. The area around the lake drain outlet should be periodically inspected for seepage which might indicate a leak of the drain pipe which could eventually initiate a piping failure through the embankment.

Photographs of the dam, appurtenment structures, the reservoirs, and the watershed are presented in Appendix D.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

Although there are controlled outlet works for this dam, no regulating procedures are known to exist. The pool is normally controlled by rainfall, runoff, evaporation and the capacities of the uncontrolled spillways. The owner has indicated that the drawdown facilities has never been used. Apparently leakage is playing an important part in keeping the water at its current level.

4.2 MAINTENANCE OF DAM:

No maintenance information was available. Some maintenance of the dam is apparently done.

4.3 MAINTENANCE OF OPERATING FACILITIES:

Although the drawdown facilities appear to be in good condition, it is not known whether they are regularly maintained.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

The inspection team is unaware of any existing warning system for this dam.

4.5 EVALUATION:

Tree and brush growth should be removed from the dam as they develop on a yearly basis. Riprap should be maintained around the plunge pool area should the lake fill to normal level. The drain outlet pipe should be checked periodically to insure that seepage does not occur. Any seepage should be brought to the attention of the owner's engineer.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES:

A. & B. Design and Experience Data:

The hydraulic and hydrologic analyses were based on: (1) a field check of spillway dimensions and embankment elevations; and (2) a check of the pool and drainage areas from the U.S.G.S. quad sheet; and (3) hydrologic design sheets by the SCS. The hydrologic and hydraulic analyses using U.S. Army Corps of Engineers guidelines appears in Appendix C.

C. Visual Observations:

The 6 1/4 inch spillway pipe appears in good condition. No trash rack was used at the inlet to prevent clogging by debris. The earth and grass covered emergency spillway is in good condition. The primary and emergency spillway has apparently never been used.

Facilities available to drawdown the pool appear to be in good condition except for soil that has washed in and filled the valve pit. The primary spillway is located near the west end of the dam and the emergency spillway is located on the east abutment. Spillway releases would not be expected to endanger the integrity of the dam.

D. Overtopping Potential:

Based on the hydrologic and hydraulic analysis presented in Appendix C, the combined spillways will pass 82 percent of the Probable Maximum Flood. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The recommended guidelines from the Department of the Army, Office of the Chief Engineers, require that this structure (small size with high downstream hazard potential) pass 50 percent to 100 percent of the PMF, without overtopping. Considering the small volume of water impounded, and the height of the dam, 50 percent of the PMF has been determined to be the appropriate spillway design flood. The structure will pass a 100-year frequency flood without overtopping.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

A. Visual Observations:

Visual observations which could adversely affect the structural stability of this dam are discussed in Section 3. In summary, no serious deficiencies which would affect the structural stability of this dam were noted during the field inspection.

B. Design and Construction Data:

Design data obtained are included in Appendix A and Appendix B. No construction data was obtained. Seepage and stability analyses comparable to the requirements of the guidelines were not available, which constitutes a deficiency which should be rectified.

C. Operating Records:

No operating records have been obtained.

D. Post-Construction Changes:

To our knowledge, no post-construction changes have been made.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in stability analyses for this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

This Phase I inspection and evaluation should not be considered as being comprehensive since the scope of work contracted for is far less detailed than would be required for an in-depth evaluation of dams. Latent deficiencies, which might be detected by a totally comprehensive investigation, could exist.

A. Safety:

The embankment is generally in good condition. Only minor items were noted during the visual inspection which should be corrected or controlled. These items are: riprap protection and erosion control. Seepage and stability analysis comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

B. Adequacy of Information:

The conclusions in this report were based on review of the information listed in Section 2.1, the performance history as related by others, and visual observation of external conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

C. Urgency:

The remedial measures recommended in paragraph 7.2 should be accomplished in the near future.

D. Necessity for Phase II:

Based on the result of the Phase I inspection, no Phase II inspection is recommended.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth

dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES:

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams.

(1) A primary spillway of increased capacity should be installed or the emergency spillway should be lined to guard against erosion. This recommendation will not be necessary unless the leakage is stopped.

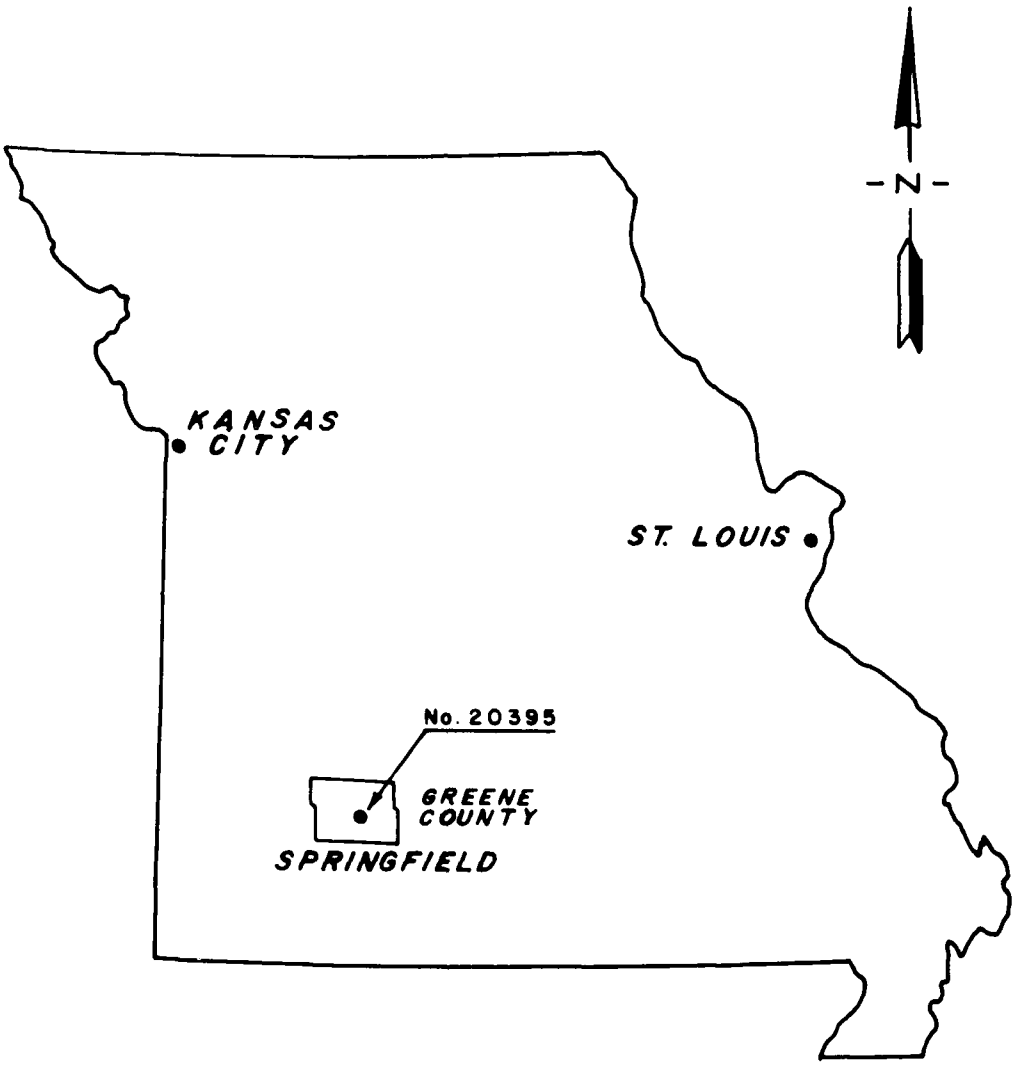
(2) Remove outlet channel constriction of rock below 6" pipe.

(3) Check the downstream slope periodically for seepage and stability problems, and around the lake drain pipe. If slides, seeps or other evidence of distress are observed, immediate inspection by a qualified engineer is required, and frequent follow-up inspections will be necessary.

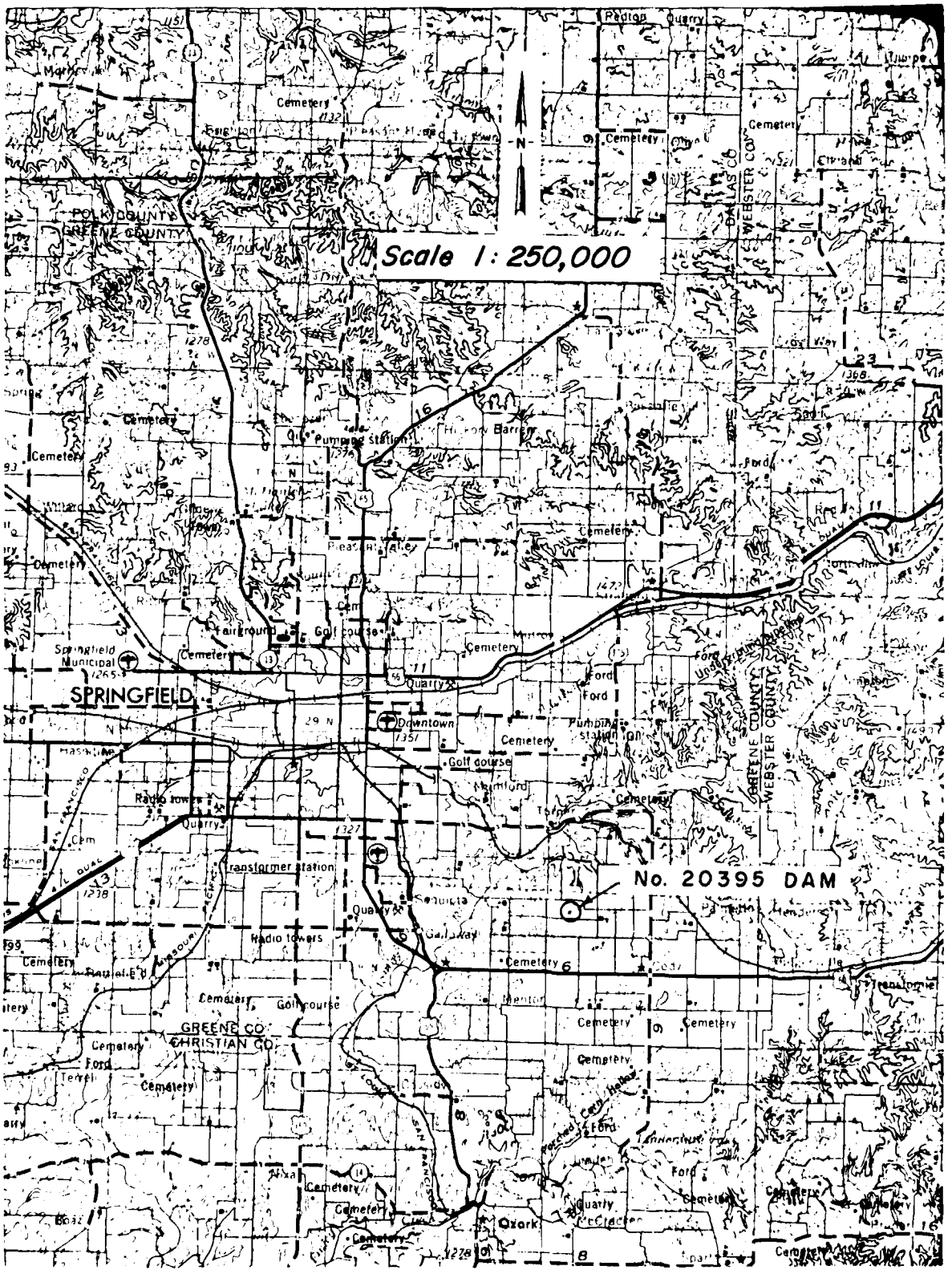
(4) A detailed inspection of the dam should be made periodically by a professional engineer experienced in the design and construction of dams. More frequent inspections may be required if slides, seeps, or other items of distress are observed.

(5) Seepage and stability analyses comparable to the requirements of the recommended guidelines should be performed by a professional engineer experienced in the construction of dams.

APPENDIX A

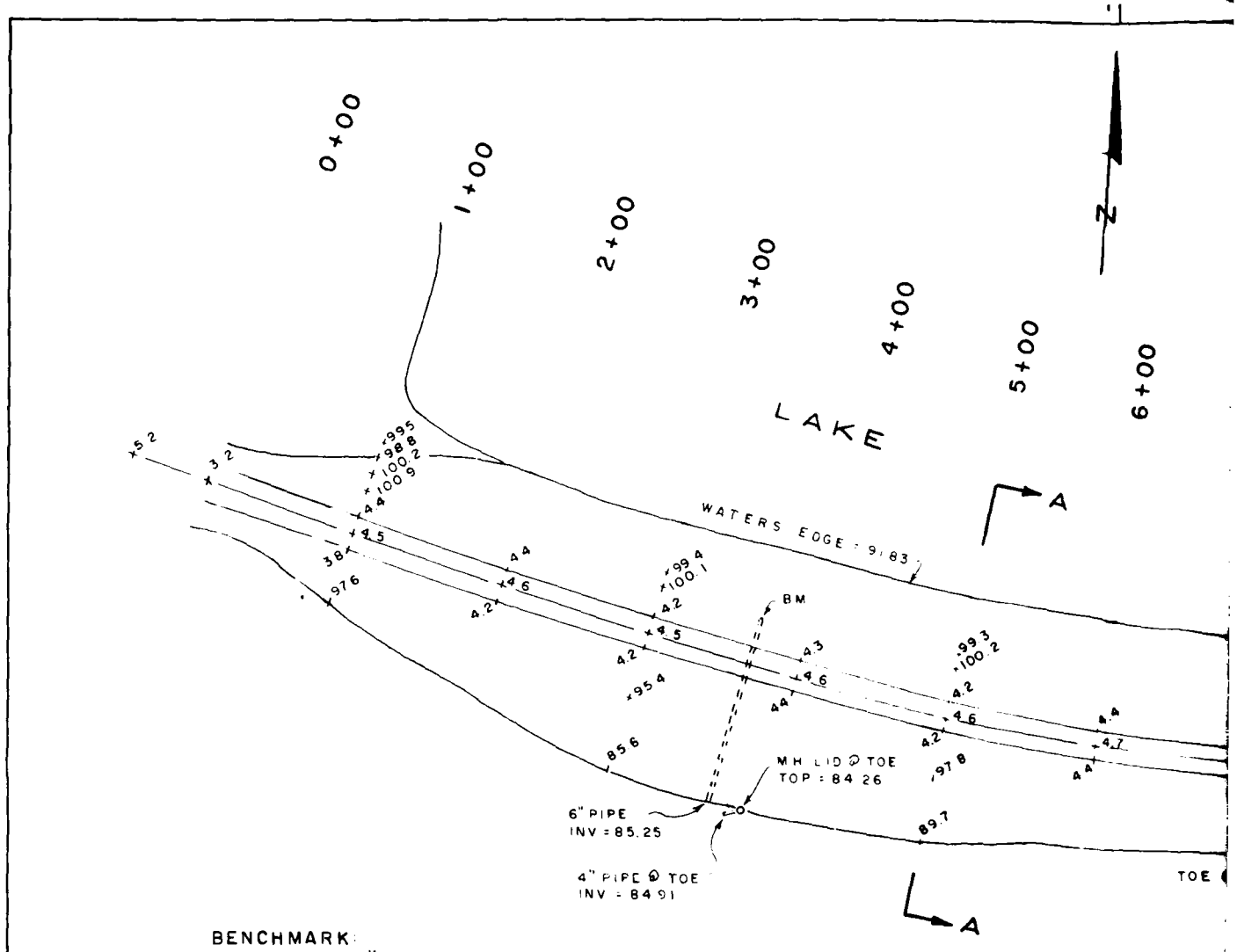


LOCATION MAP



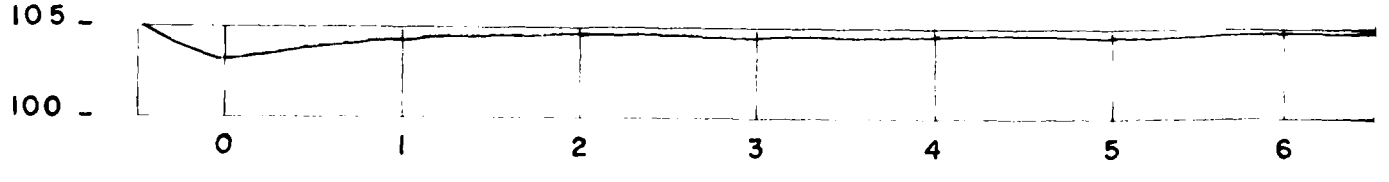
SITE VICINITY MAP

Sheet 2 Appendix A

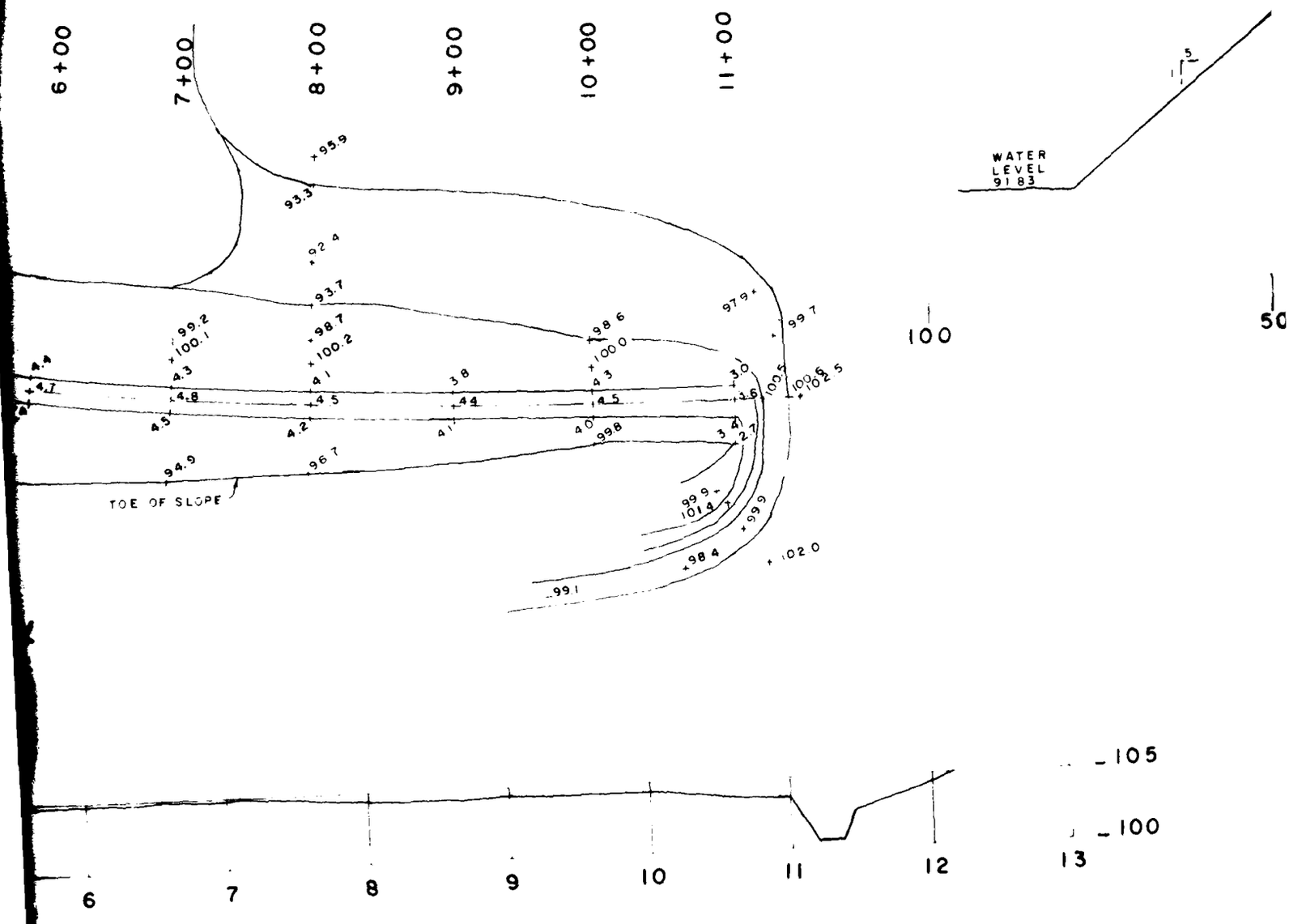


BENCHMARK:
INVERT OF 6" PIPE SPILLWAY
ELEV. = 100.00

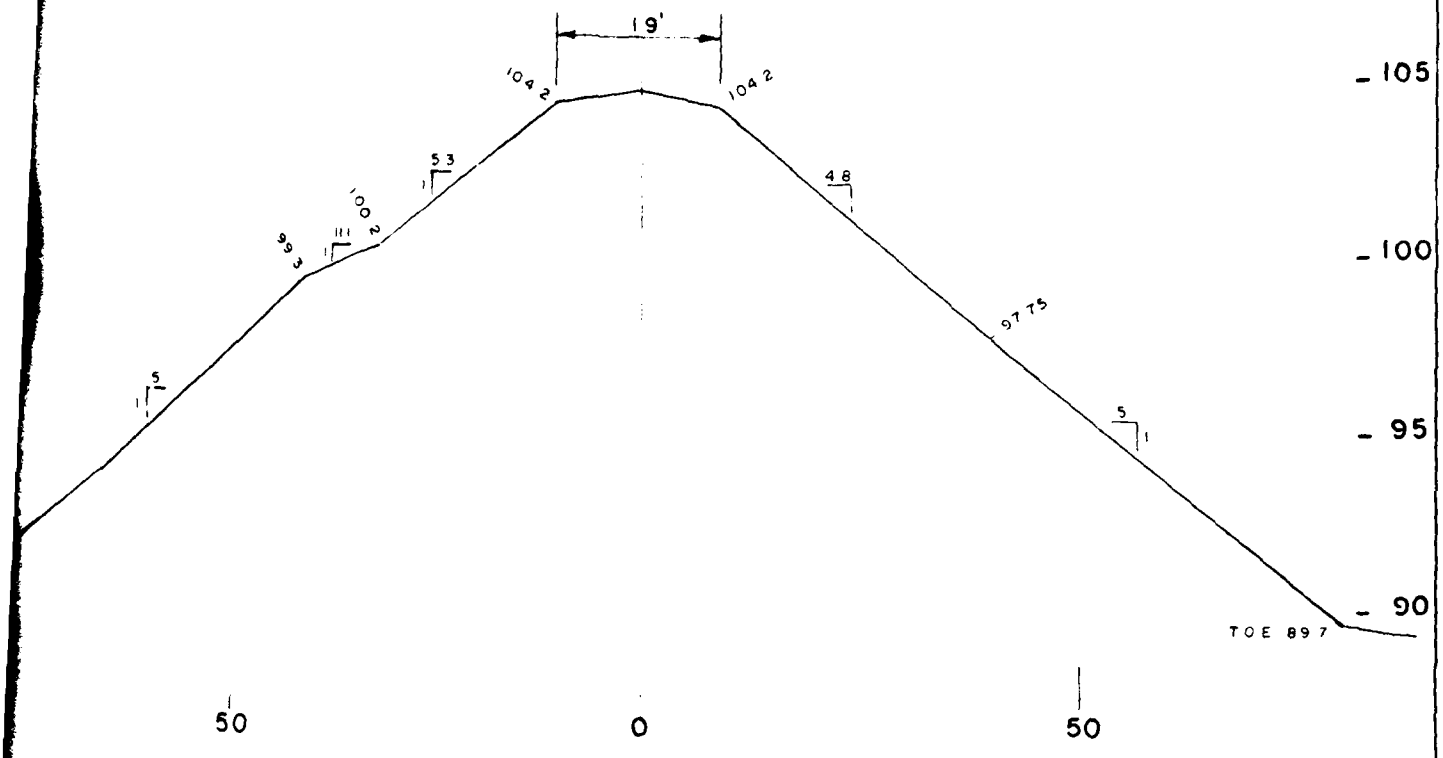
PLAN VIEW
SCALE: 1" = 100'



PROFIL


6+00
7+00
8+00
9+00
10+00
11+00
WATER LEVEL 9183
TOE OF SLOPE
100
50
105
100
6
7
8
9
10
11
12
13

ROFILE



SECTION A-A STA 5+00

105

100

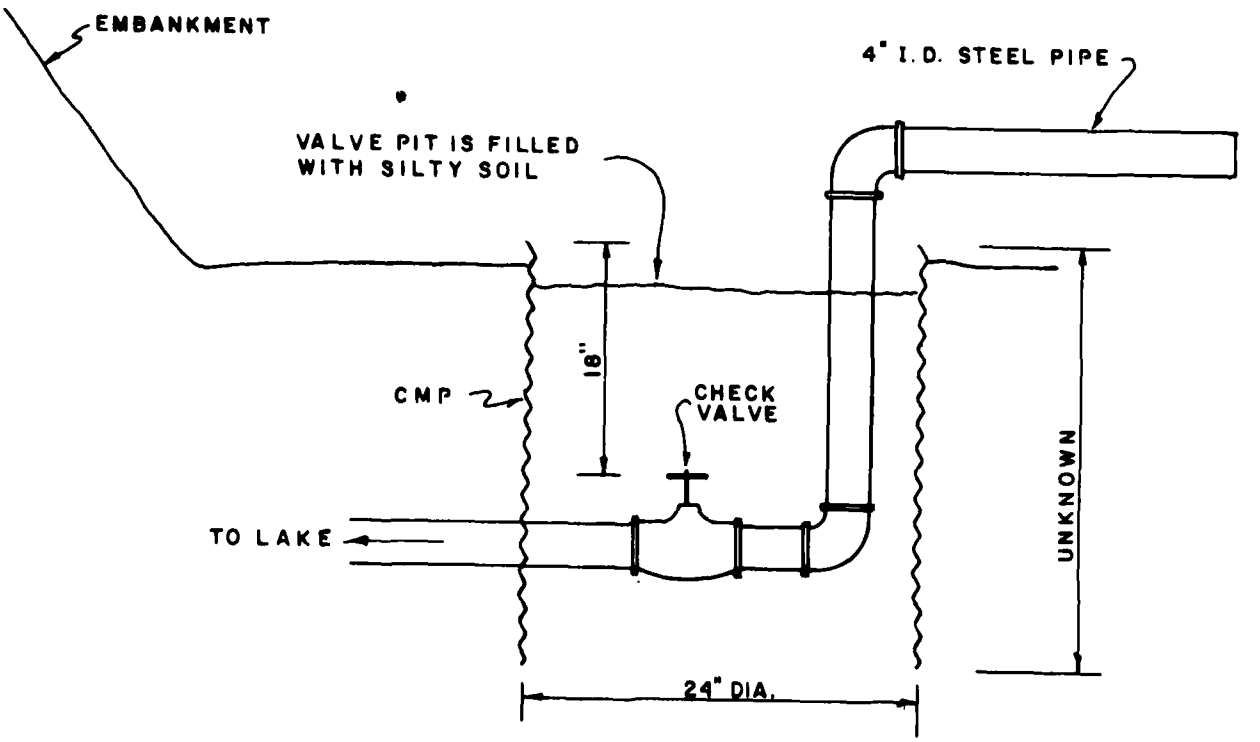
ANDERSON ENGINEERING, INC.
730 SOUTH BENTON AVENUE
SPRINGFIELD, MISSOURI 65802

LEO JOURNAGAN LAKE

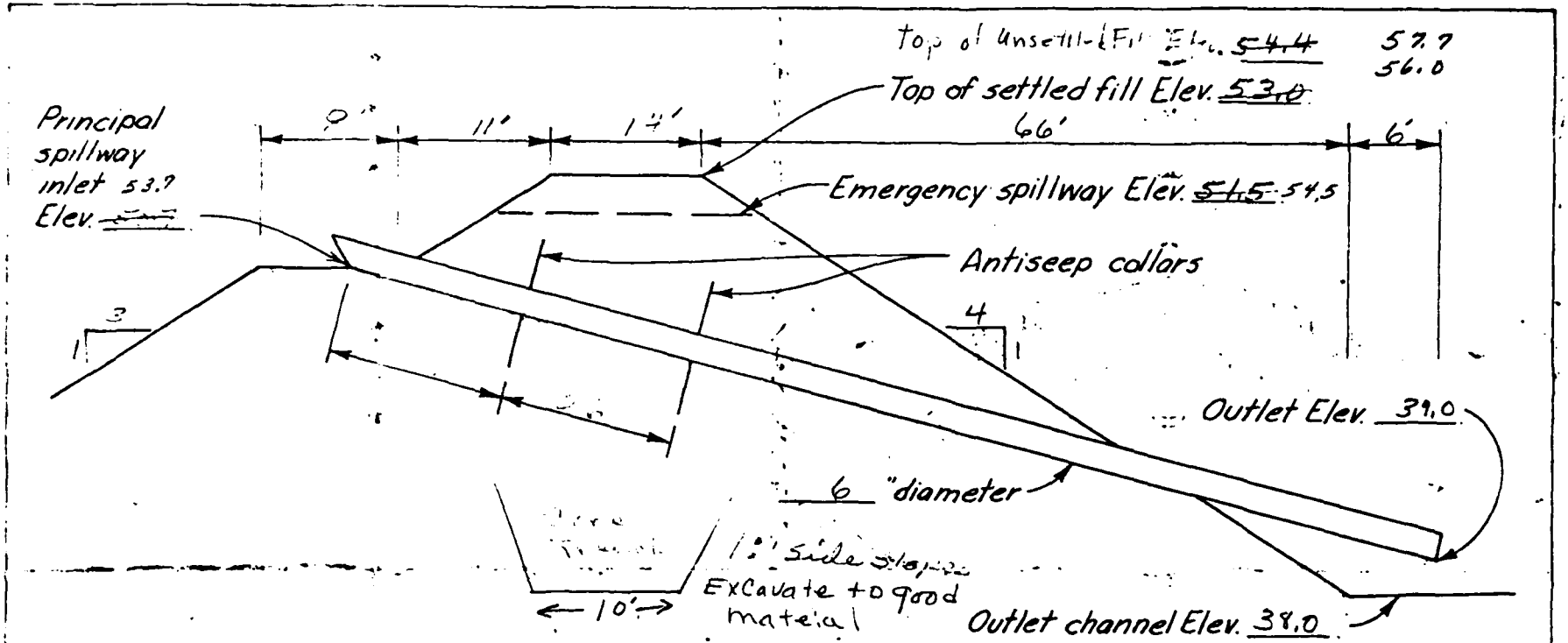
MO. No. 20395

PLAN & PROFILE

GREENE COUNTY, MO.



LAKE DRAWDOWN VALVE PIT



SECTION ALONG ℄ PRINCIPAL SPILLWAY

Not to Scale

ESTIMATED QUANTITIES		
QUAN.	UNIT	ITEM
14,367	Cu.yds.	Earth Embankment
1200	Cu.yds	Core Trench Excavation
100	Lf	6" Smooth steel or Plastic or Corr. C.M.P.
2	No	54" X 54" Antiseep Collar
150	Lf	1¼ plastic Pipe minimum

Sheet 5 of Appendix A

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HOOD INLET SPILLWAY

Landowner Lee Journagan
Lincoln County, Missouri
Designed by C. Mumma & C. Wright Date 8/15/74
Checked by Date
Approved by Date 8/15/74
Sheet of

5,L-27.

MO-ENG-15
Rev. 11/72
File Code: ENG-13

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

EARTHWORK COMPUTATION SHEET FOR EARTH DAM

Landowner or Watershed _____ Location or Sub-watershed _____

Top of Fill: Width 16 feet; Elev. 53.0. Side Slopes: Downstream 2:1; Upstream 3:1

Upstream Berm: Width 8 feet; Elev. 50.7. Downstream Berm: Width _____ feet; Elev. _____

Computed by _____ Date _____ Checked by _____ Date _____

Station	Ground Elev. Ft.	Main Fill		Upstream Berm		Downstream Berm		Total Fill Quantity Cu. Yd. Per ft.	Sum of Fill Quantity Cu. Yd. Per ft.	Distance Between Stations Ft.	Double Fill Quantity Cu. Yd.
		Fill Height Ft.	Fill Quantity Cu. Yd. Per ft.	Fill Height Ft.	Fill Quantity Cu. Yd. Per ft.	Fill Height Ft.	Fill Quantity Cu. Yd. Per ft.				
0+00	51.5	0.0	0.0	[illegible]	0.0				XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXX
									1	30	3.0
+30	50.9	2.1		.2	.1				.4	55	22.0
+85	49.6	3.4		1.1	.3				.9	60	54.0
1+45	48.6	4.4		2.1	.6				1.8	65	117.0
2+10	46.8	6.2		3.7	1.2				3.0	55	165.0
+65	45.6	8.4		6.1	1.8				4.3	55	236.5
3+20	44.4	10.6		8.3	2.5				5.5	55	302.5
+75	40.6	13.4		10.1	3.0				6.4	50	320.0
4+25	39.3	13.7		11.4	3.4				6.8	55	374.0
+80	39.3	13.7		11.4	3.4				6.9	60	414.0
5+40	38.0	14.0		11.5	3.5				6.9	45	310.5
+85	37.4	13.6		11.3	3.4				5.9	65	383.5
6+50	41.1	10.9		8.6	2.5				4.0	45	180.0
+95	45.5	7.5		5.2	1.5				1.9	45	85.5
7+40	49.2	4.0		1.7	.4				.4	55	22.0
+95	52.2	.8		0.0	0.0						
8+30	53.0	0.0		0.0	0.0						
									XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX		

Total Double Fill Quantity 2989.5

Fill Quantity 1494.8

Allow _____ % for Settlement. . . . . _____

Side Spillway Fill (Including Dikes). . _____

Backfill for Core Trench Excavation . . _____

Backfill for Structure Excavation . . . _____

Backfill for Stripping. . . . . _____

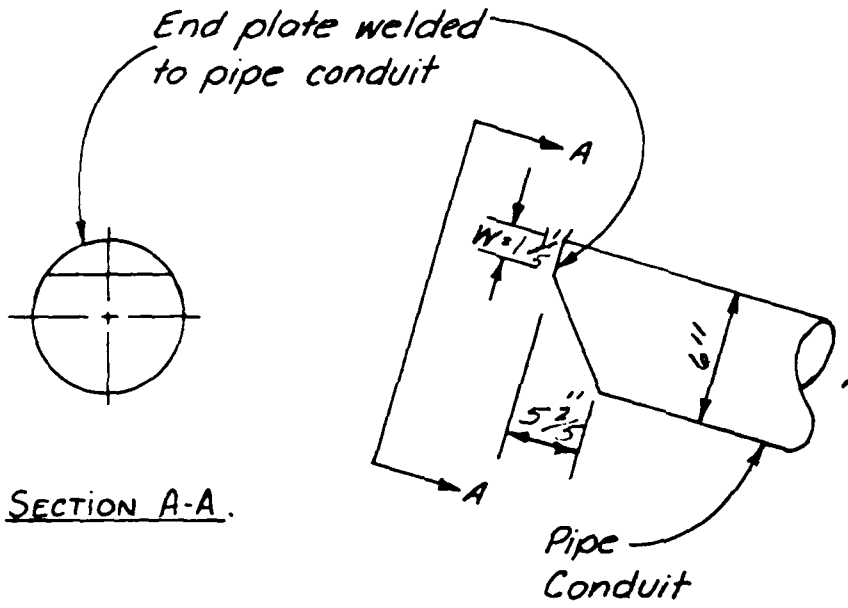
Total Fill Quantity (Class _____) . . . _____

USDA-SCS-LINCOLN, NEBR. 1972

S-L-30, 884

Sheet 6 of Appendix A

MO-ENG-58 Rev. 2/73 File Code: ENG-13



SECTION A-A.

SECTION ALONG ℄ OF PIPE

Notes:

1. Minimum gage of pipe and end plate shall be ____.
2. Weld between end plate and pipe conduit shall be water-tight and covered with two coats of zinc-oxide paint.
3. Dimension W shall be measured from the valley of the corrugations.

Minimum gage 16 for CMP
minimum gage 12 or .105" for smooth steel

Sheet 7 of Appendix A

Not to Scale

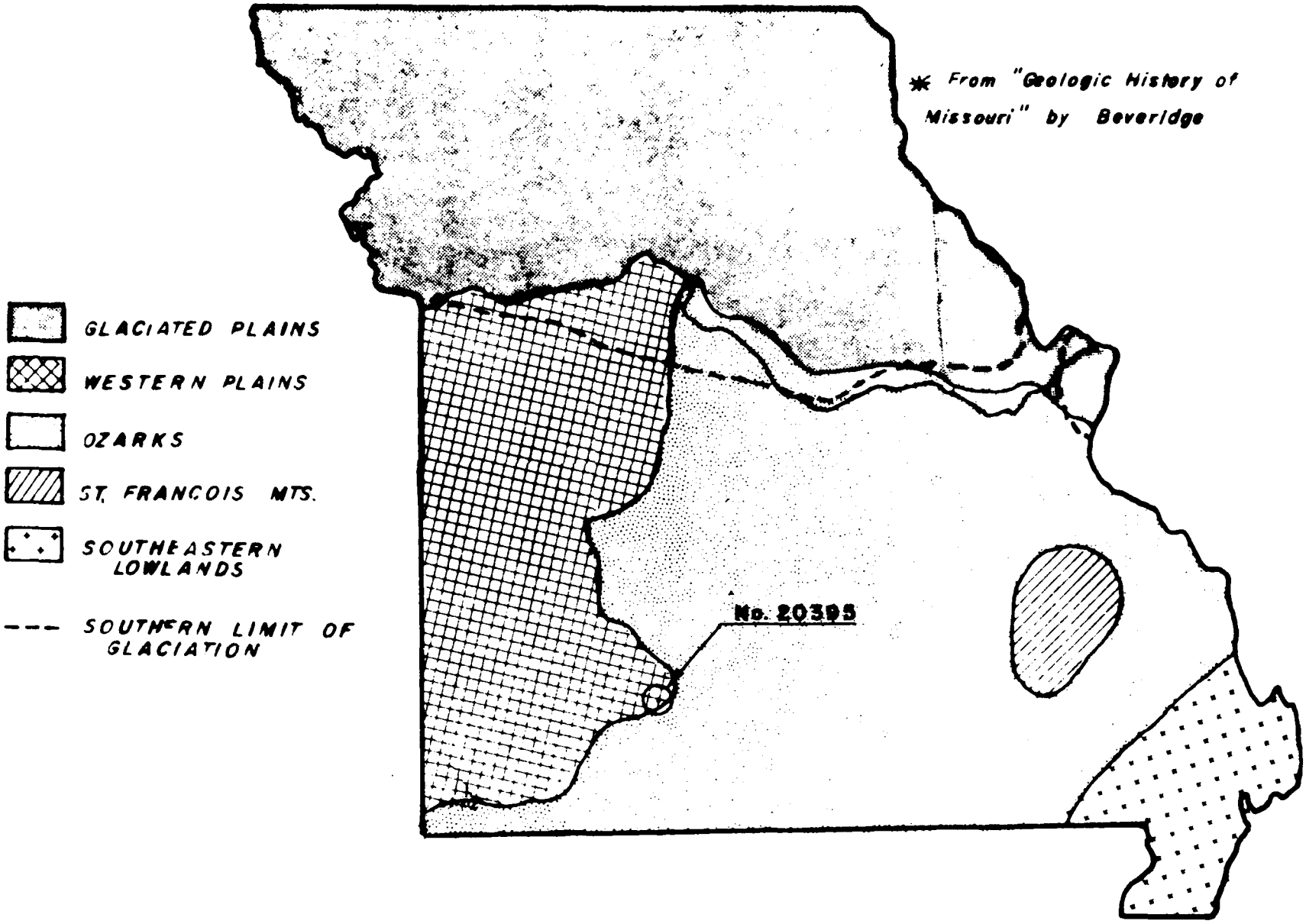
UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
DETAILS OF CORRUGATED METAL PIPE CANOPY INLET SPILLWAY	
Landowner Lee Journagan Kleese	County, Missouri
Designed by C. Mumma & C Wright	Date 8/15/79
Checked by	Date
Approved by	Date
Sheet of	

5,L-28,453

APPENDIX B

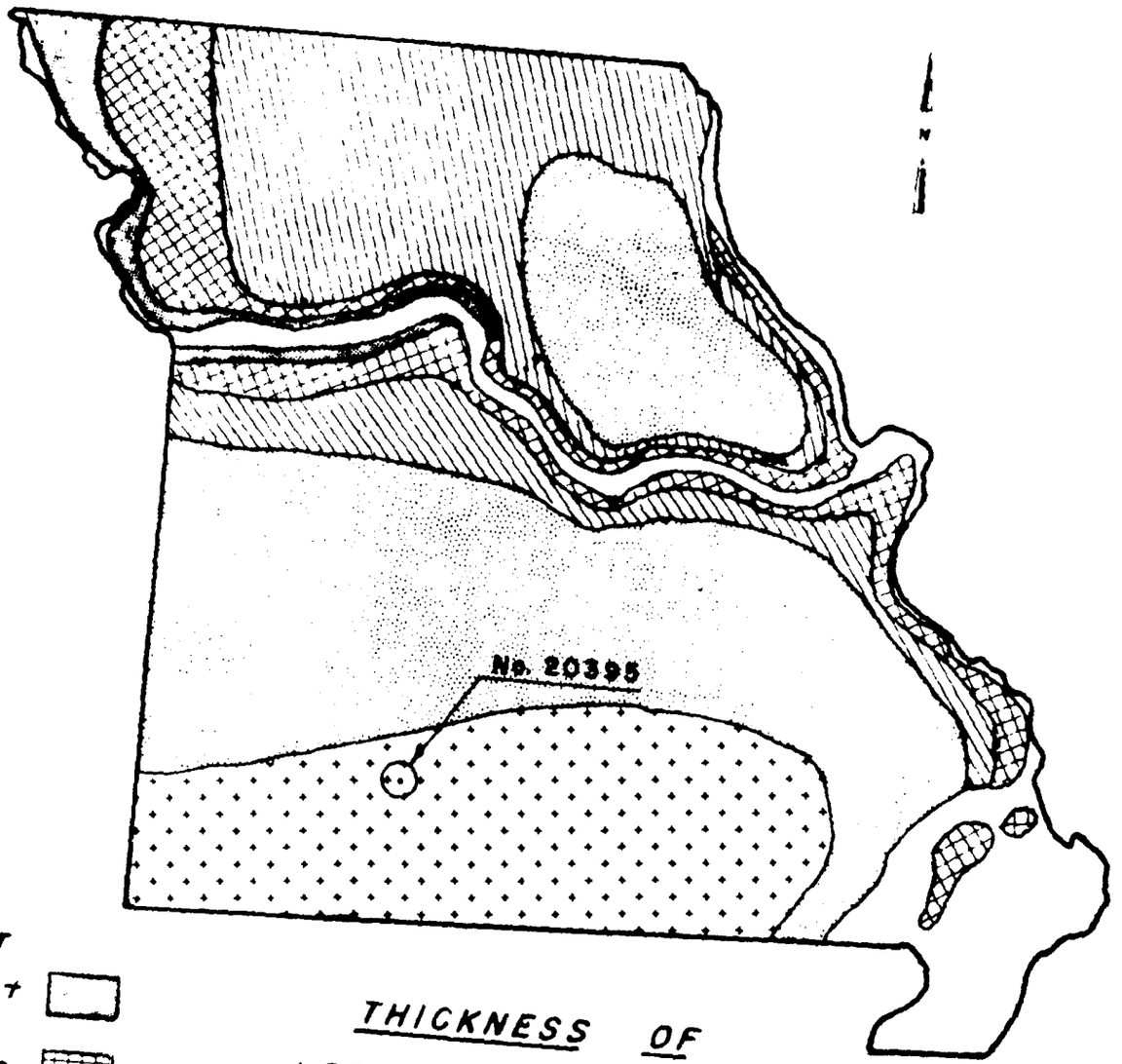
APPENDIX B

MAJOR GEOLOGIC REGIONS OF MISSOURI



SHEET 1 OF APPENDIX B

* From "Soils of Missouri"



FEET

20+

10-20

5-10

2.5-5

2.5-

THICKNESS OF LOESSIAL DEPOSITS

SHEET 2 OF APPENDIX B

Soil's Information for Leo Journogan

03B Goss Cherty Silty Loam (2-5% slope) III S6

This is a deep, well drained soil with moderately slow permeability. Typically, the surface is dark grayish brown cherty silt loam and the subsoil is reddish brown, red, and yellowish brown cherty silty clay. Beneath the subsoil is a light gray clay.

021B or 02B or 010B or 01B Britwater Silt Loam, (2-6% slope) II e1

This soil is a deep, well drained, moderately permeable soil. The surface layer is a brown gravelly silt loam, and the subsoil is a reddish gravelly silty clay loam.

03D or 66C or 035D Goss Stoney Cherty Silt Loam (5-14% slope) VI S6

This is a deep. well drained soil with moderately slow permeability. Typically, the surface is dark grayish brown cherty silt loam and the subsoil is reddish brown, red and yellowish brown cherty silty clay. Beneath the subsoil is a light gray clay.

921 Razort Silt Loam (0-3% slope) II S1 or 92

This is a well drained moderately permeable soil on low terraces. They have dark yellowish brown to very dark brown loamy surface layers and brown to dark brown silt loam to clay loam subsoil. Below is variable material ranging from silt loam gravel, or bedrock. The available water capacity is medium.

081B or 061B (Except surface it is very dark grayish brown) Viraton Silt loam (2-5% slope) II e5

This is a moderately well drained soil with fragipan. Moderate permeability above the fragipan and slow in the fragipan. The surface is grayish brown silt loam, the subsoil is yellowish brown silt loam, the subsoil is yellowish heavy silt loam over dark brown to strong brown silty clay loam over mottled brown, yellowish brown, and strong brown cherty silty clay loam. The fragipan is mottled very cherty silt loam. The avialable water capacity is medium.

L.S.
#5

(file only)

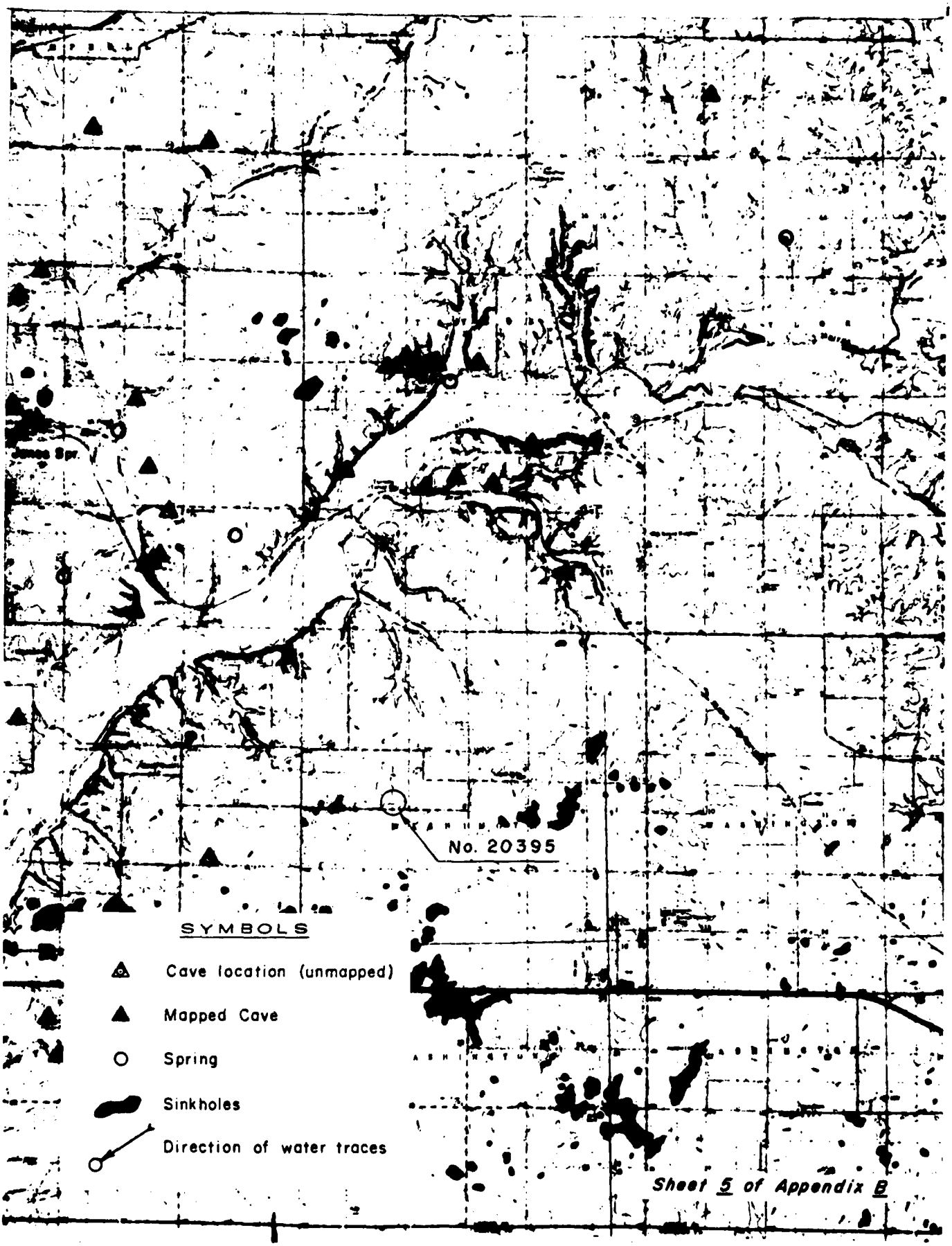
JOURNAGAN LAKE SITE

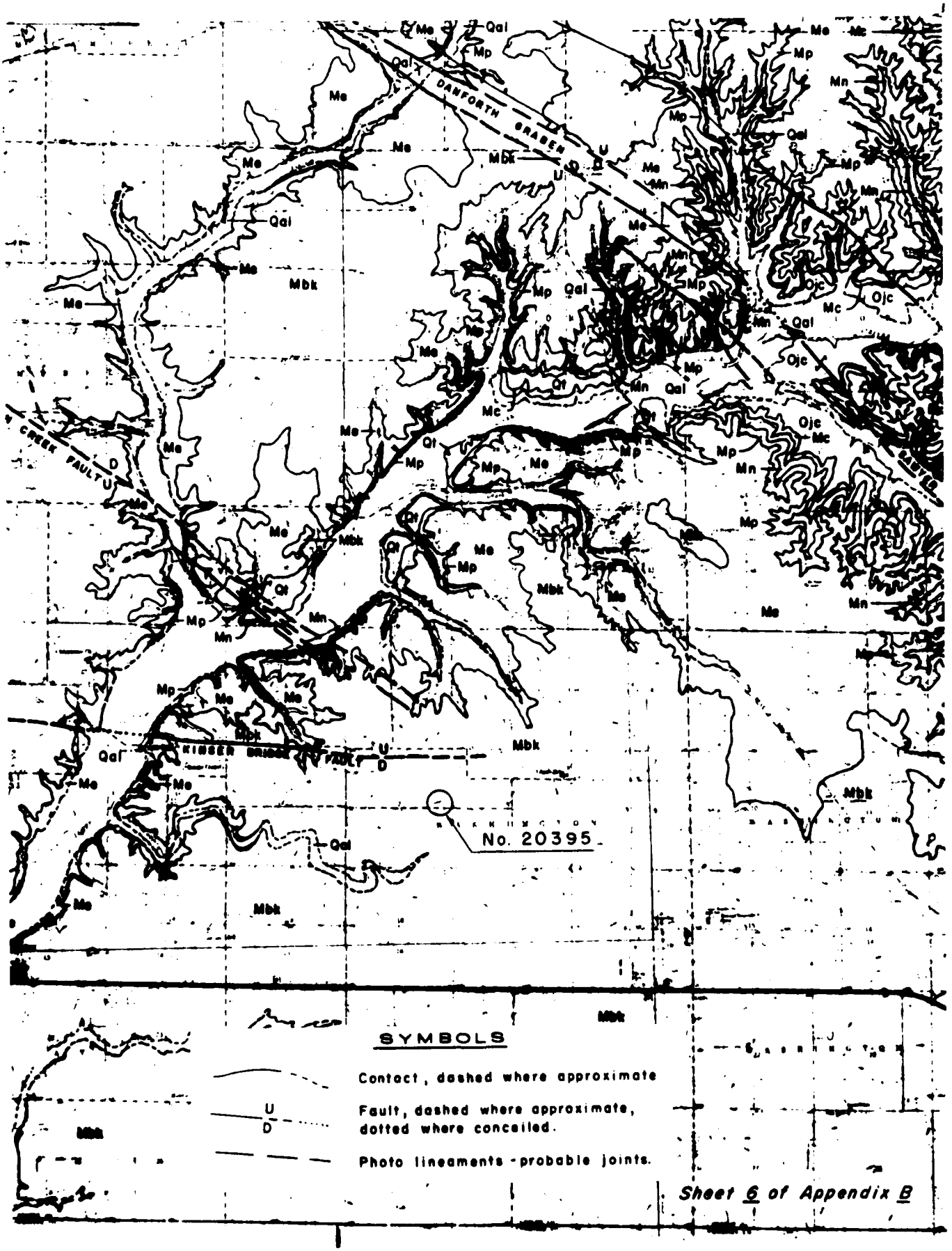
Greene County, Mo.

LOCATION: NE¼, Sec. 7, T. 28 N., R. 20 W., Galloway Quadrangle.

Charles Mumma of the Soil Convervation Service asked me to look at a sinkhole collapse that had occurred in the upper part of this large lake site, which is in the progress of construction. On January 8, 1975, a field inspection was made on the sink. The hole was approximately three feet in diameter and nine feet deep. It had straight or vertical wall and penetrated soil its entire depth. The soil consist of layers of silty clay and gravelly or bouldery clay. The layers were two to three feet thick. The sink occurred in the upper part of the lake basin, directly downstream from an area where pinnacle bedrock has been exposed by excavation work. Mumma suggested scraping the sinkhole out nine feet and backfilling with compacted clay. Since the dam and lake was already partially completed, this is about all that could be done. I suggested if at all possible to leave this area open the remainder of the winter so that if any other near surface sinkholes are present, they have a chance of collapsing before the dam is complete. The lake is located in a broad upland basin and apparently had thick layers of brown silty clay overlying the red Burlington gravelly clay. The silty clays look like excellent material for a lake basin, but they were scraped off and the underlying red clay pinnacle area was exposed.

John W. Whitfield, Geologist
Applied Engineering & Urban Geology Section
Office of State Geologist
January 16, 1975


No. 20395
SYMBOLS
Cave location (unmapped)
Mapped Cave
Spring
Sinkholes
Direction of water traces



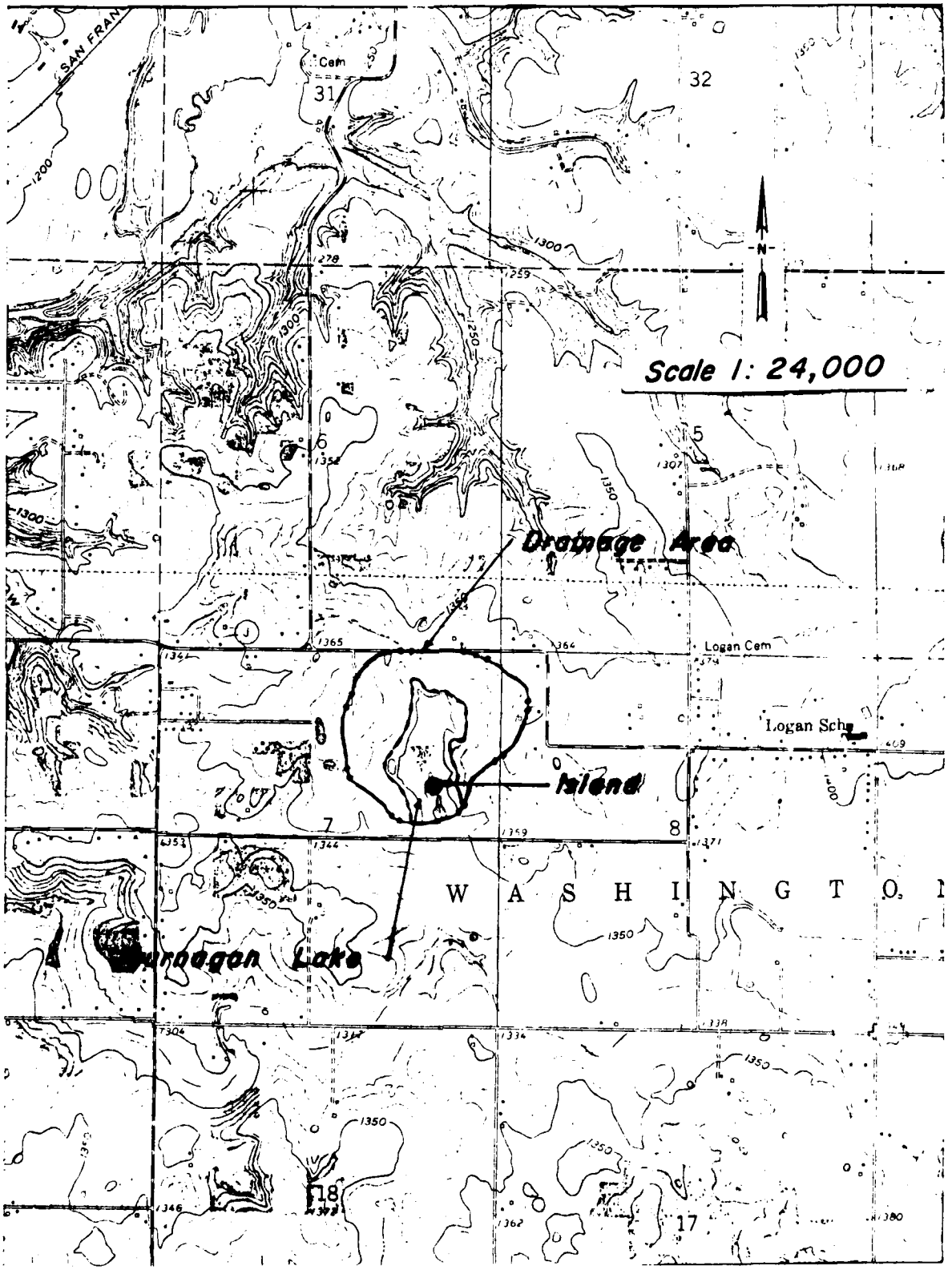
SYMBOLS

Contact, dashed where approximate

Fault, dashed where approximate, dotted where concealed.

Photo lineaments - probable joints.

APPENDIX C



LAKE AND WATERSHED MAP

Sheet 1 Appendix C

HYDRAULICS AND HYDROLOGIC DATA

Design Data: From Field Measurements.

Experience Data: No records for high water marks are available. The owner has indicated that the lake has never filled to pool level since construction. The emergency and primary spillways have apparently never been used.

Visual Inspection: At the time of inspection, the pool level was 91.83 about 8.2 ft. below normal pool (elevation 100.0).

Overtopping Potential: Flood routings were performed to determine the overtopping potential. Since the dam is of small size with a high hazard rating and has a small storage capacity, a spillway design storm of 50 percent of the PMF was determined from the guidelines. The watershed drainage area was obtained from SCS data sheet and checked by planimeter from the U.S.G.S. 7.5 minute, Galloway, Missouri quadrangle map. The value of the drainage area obtained for the total watershed and for the reservoir, was less than that included in the SCS data. In our computations the larger value was used.

The values for the reservoir area and the storage-elevation relationship were obtained by planimeter from the Galloway quadrangle map.

A 5 minute interval unit-graph was developed for the watershed which resulted in a peak inflow of 454 c.f.s. and a time to peak of 15 minutes. Application of the probable maximum precipitation, minus losses resulted in a flood hydrograph peak inflow of 2,685 c.f.s. Rainfall distribution for the 24 hour storm was according to EM 1110-2-1411.

Considering all factors the combination of dam, spillway and storage is not sufficient to pass the PMF without overtopping the embankment. The crest elevation of 104 ft. would be overtopped by 0.28 ft. at flood pool elevation 104.28.

Fifty percent of the PMF was routed through the spillway and reached a pool elevation of 103.11 ft., which is 0.89 ft. below the crest. The portion of the PMF that will just reach the top of the dam is about 82 percent which is greater than the 100 year flood event. For additional information see the Summary of Dam Safety Analyses on Sheet 6.

OVERTOPPING ANALYSIS FOR JOURNAGAN LAKE DAM

INPUT PARAMETERS

1. Unit Hydrograph - SCS Dimensionless - Flood Hydrograph Package (HEC-1); Dam Safety Version Was Used.
   Hydraulic Inputs Are as Follows:

   a. Twenty-four Hour Rainfall of 26.9 Inches for 200 Square Miles - All Season Envelope

   b. Drainage Area = 140 Acres; = 0.22 Square Miles

   c. Travel Time of Runoff 0.31 Hrs.; Lag Time 0.19 Hrs.

   d. Soil Conservation Service Soil Group B

   e. Soil Conservation Service Runoff Curve No. 88 A.M.C. Condition III

   f. Proportion of Drainage Basin Impervious 0.01

2. Spillways

   a. Primary Spillway: 6 inch CMP Hood Inlet

   b. Emergency Spillway

      Length 17 ft.; Side Slopes 5:1; C = 3.1

   c. Dam Overflow

      Length 1100 ft.; Side Slopes 5:1; C = 3.0

   Note: Spillway and Dam Rating Curve Prepared by Hanson Engineers. Data Provided to Computer on Y4 and Y5 Cards.

   Equation Used for Spillway: $\frac{Q}{g}^2 = \frac{A}{T}^3$

SUMMARY OF DAM SAFETY ANALYSIS

1. Unit Hydrograph

   a. Peak - 454 c.f.s.

b. Time to Peak 15 Min.

2. Flood Routings Were Computed by the Modified Puls Method

a. Peak Inflow

50% PMF 1343 c.f.s.; 100% PMF 2685 c.f.s.

b. Peak Elevation

50% PMF 103.11; 100% PMF 104.28

c. Portion of PMF That Will Reach Top of Dam

82%; Top of Dam Elev. 104 Ft.

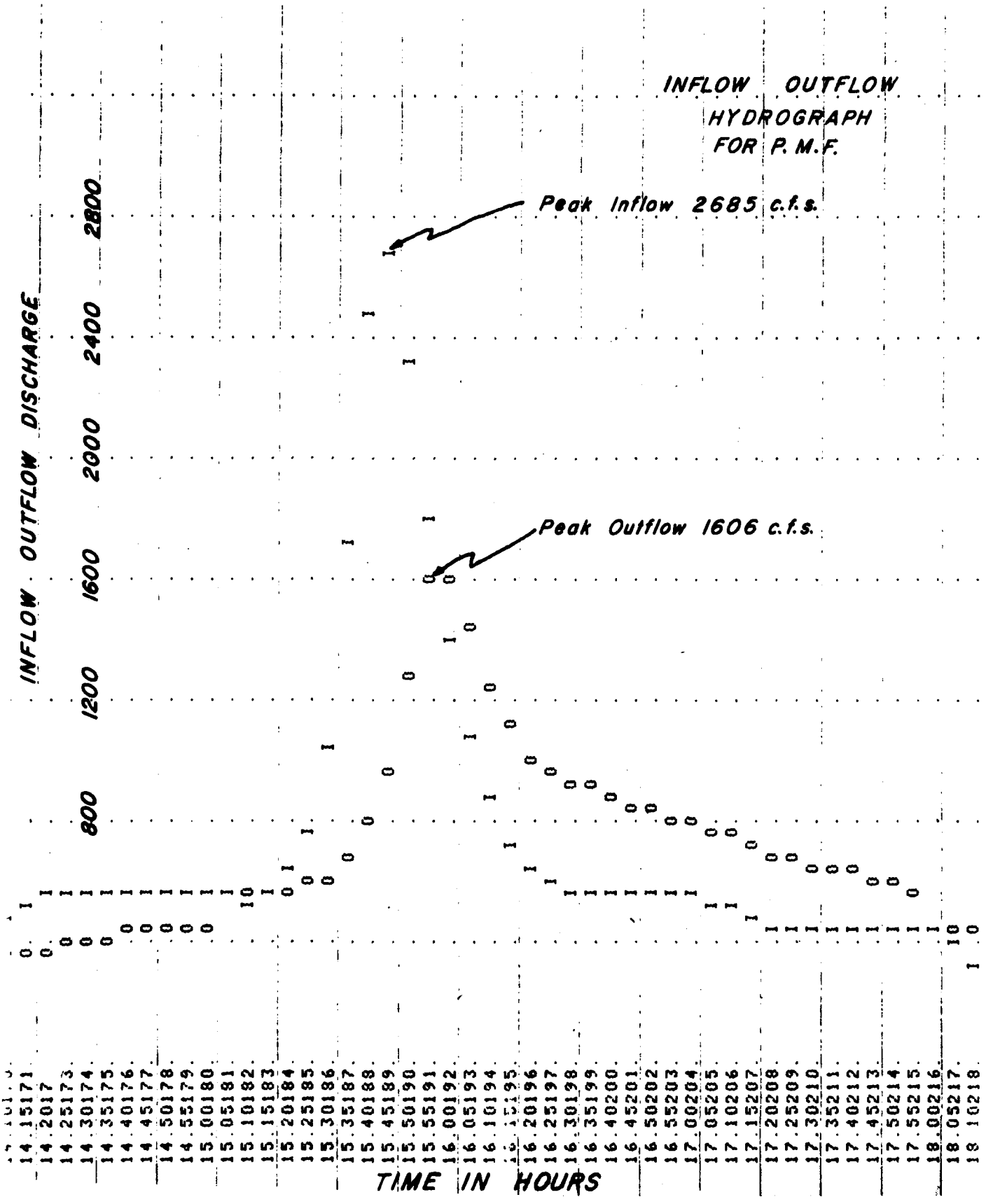
Note: Time of concentration from equation $Tc = \left(\frac{11.9\ L^3}{H}\right)^{.385}$ California Culvert Practice, California Highways and Public Works, September 1942. Lake surface area at primary pool elevation and top of dam are exclusive of the estimated area of the island. Storage volume between the two elevations is based on average area times depth.

```
     OVERTOPPING ANALYSIS FOR JOURNAGON LAKE SITE DAM #5
     CO CODE 077 GREENE CO STATE ID# NO 20395 OWNER LEO JOURNAGON
     HANSON ENGINEERS INC DAM SAFETY INSPECTION JOB #79511
   300                5                                                0
1    5
     1   4      1
1  0.50   0.80   0.90    1.0
     0     1                          3       1
1      INFLOW HYDROGRAPH COMPUTATION
     1     2   0.22          0.22       1                        1
     0  26.9    102    120    130
                                                 -1     -88            0.01
2  0.31   0.19
     0   -0.1     2
     1     2                  2              1
1      RESERVOIR ROUTING BY MODIFIED PULS AT JOURNAGON LAKE DAM
                                1      1
1    1                                          112     -1
4  100  100.5    101    102    103    104
5    0      2     23    154    461    987
A    0     21     35
E   84    100    104
$  100
D  104    3.0    1.5   1100
K   99
```

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	100.00	104.00
STORAGE	112.	112.	223.
OUTFLOW	0.	0.	987.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	103.11	0.00	193.	618.	0.00	16.00	0.00
0.80	103.97	0.00	222.	973.	0.00	16.08	0.00
0.90	104.17	0.17	229.	1294.	0.42	16.00	0.00
1.00	104.28	0.28	233.	1606.	0.58	15.92	0.00


INFLOW OUTFLOW
HYDROGRAPH
FOR P.M.F.
Peak Inflow 2685 c.f.s.
Peak Outflow 1606 c.f.s.
INFLOW OUTFLOW DISCHARGE
800
1200
1600
2000
2400
2800
TIME IN HOURS

MO-ENG-40
Rev. 6/73
File Code: ENG-13

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DESIGN SHEET FOR CLASS II, III, IV * DETENTION STORAGE STRUCTURE
WITH DROP INLET SPILLWAY -- HOOD INLET SPILLWAY -- CANOPY INLET SPILLWAY *

Landowner Lee Journagan County Greene

Design by C. Mumme Date 8-15-74 Checked by _____ Date _____

Drainage area = 140 ac. Height x storage = _____ x _____ = _____

WATERSHED CONDITIONS AND FACTORS

Location factor:	L = 1.1
Infiltration factor: (above) (average) (below) *	I = .9
Topographic factor: 4 % average slope	T = .8
Shape factor: runoff distance = 3200 ft.	S = 1.1
Cover factor: cropland _____ %, pasture 100 %, timber _____ %	V = .7
Contouring factor:	C = 1
Storage factor: _____ % terraced	P = 1

PEAK RATE OF RUNOFF AND VOLUME OF RUNOFF

Product of factors = L x I x T x S x V x C x P = .6 Q_{10} = 193 c.f.s.

V x I = .7 x .9 = .63

For Principal Spillway Design:

2 -year peak rate of runoff = Q_{ip} = .5 x 193 c.f.s. = 97 c.f.s.

Rate of volume of runoff = .04 ac. ft./ac. (Table 1, 1519)

Total volume of runoff = V_{rp} = (drainage area) x (rate of volume of runoff) x L =

140 ac. x .04 ac. ft./ac. x 1.1 = 6.2 ac. ft.

For Both Spillways (Total Structure):

25 -year peak rate of runoff = Q_i = 1.3 x 193 c.f.s. = 251 c.f.s.

Rate of volume of runoff = .12 ac. ft./ac.

Total volume of runoff = V_r = 140 ac. x .12 ac. ft./ac. x 1.1 = 18.5 ac.ft.

*Mark out those items that do not apply.

Instructions for use of form: Make one pencil copy for applicable structure. File with other worksheets and structure plan in landowner's folder in field office.

USDA SCS LINCOLN NEBR 1979

P.S 531 537
ES 515 547
TD 530 527

PRINCIPAL SPILLWAY DESIGN

Available storage at stage of .8 ft. = V_{sp} = 13.02 ac. ft. (See map)

$V_{sp} \div V_{rp}$ = 13.02 ac. ft. ÷ 6.2 ac. ft. = —. $Q_{op} \div Q_{ip}$ = _____ (Table 2, 1519)

Q_{op} = _____ c.f.s. x _____ = _____ c.f.s.

Conduit:

Type_____ Length = _____ ft. Total head on conduit = _____ ft.

Diameter = _____ in. Discharge capacity = _____ c.f.s. (1520)

Minimum entrance head = _____ ft. (1510 or 1511)

Riser: **

Type_____ Height = _____ ft. Diameter = _____ in. (1511)

EMERGENCY SPILLWAY DESIGN

Control Section:

Depth of flow = .5 ft. V_s at this depth = 22.13 ac. ft. (See map)

$V_s \div V_r$ = 22.13 ac. ft. ÷ 18.5 ac. ft. = —

$Q_{op} \div Q_i$ = _____ c.f.s. ÷ _____ c.f.s. = _____. $Q_{oe} \div Q_i$ = _____ (Table 3, 1519)

Q_{oe} = _____ c.f.s. x _____ = _____ c.f.s.

Width = 10 ft. Total depth = depth of flow + freeboard = .5 ft. + 1.0 =

1.5 ft. Use 1.5 ft. (Table 4, 1517)

Exit Section:

Slope = _____ % Quality of vegetation: (fair) (good) (excellent) *

(Less) (More) * erosive soils. Permissible velocity = _____ f.p.s. (1517)

Depth = _____ ft. Design velocity = _____ f.p.s. Width = _____ ft. (1517 or 1505)

Use width of _____ ft.

ANTI-SEEP COLLARS

Length of saturated zone = L = 80 ft. Collar addition = 8.0 ft. (1515)

Number = n = (L x _____) ÷ V = (_____ x _____) ÷ _____ = _____. Use_____ collars.

* Mark out those items that do not apply.
** Applies only to Drop Inlet Spillways.

2 @ 54" x 54"

APPENDIX D

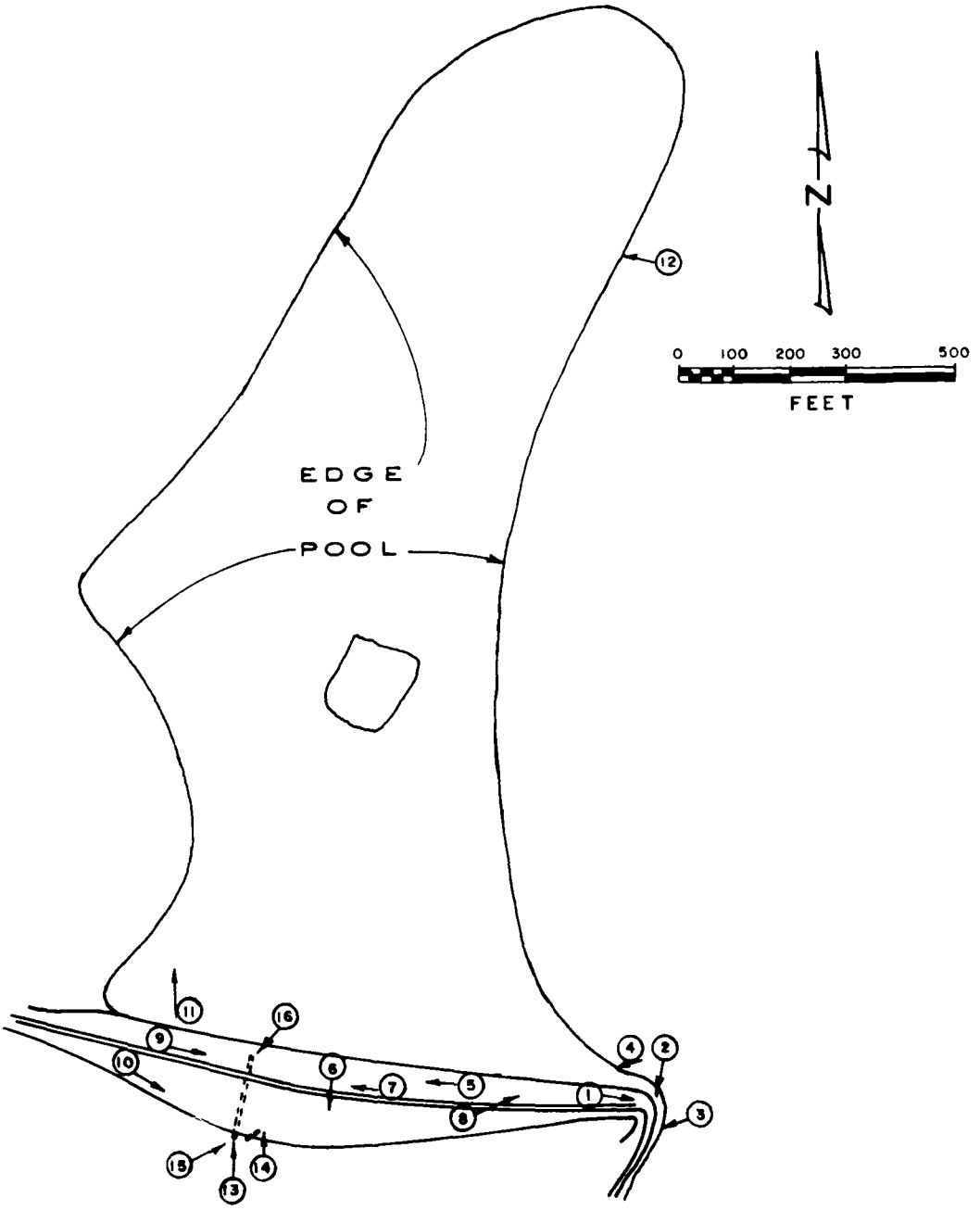


PHOTO INDEX

LEO JOURNAGAN LAKE

GREENE COUNTY, MO

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4.	Approach to Emergency Spillway
5.	Upstream Slope
6.	Outlet Channel Looking Downstream
7.	Top of Embankment
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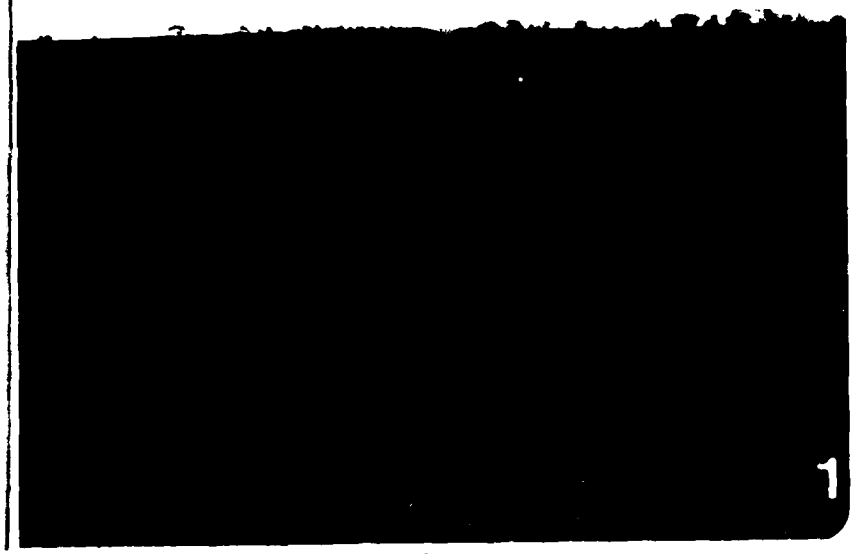
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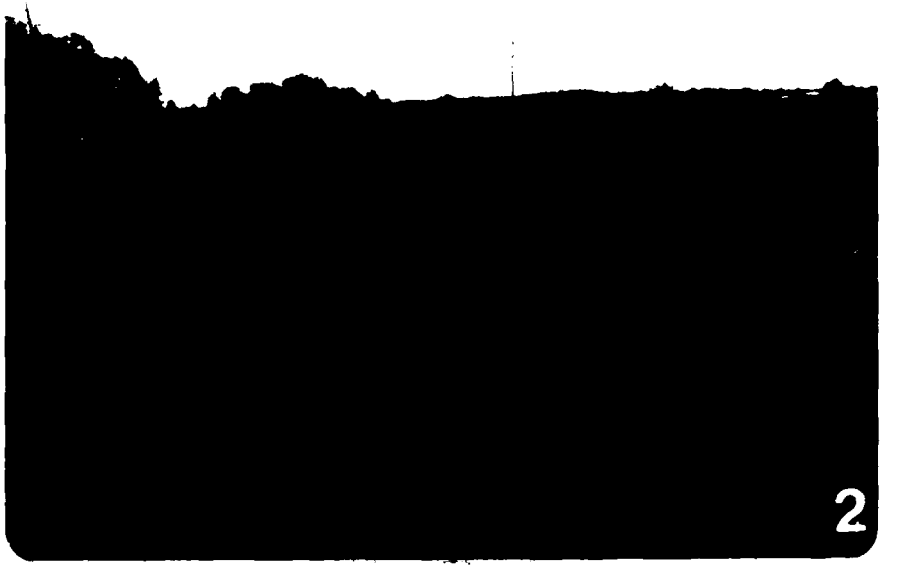
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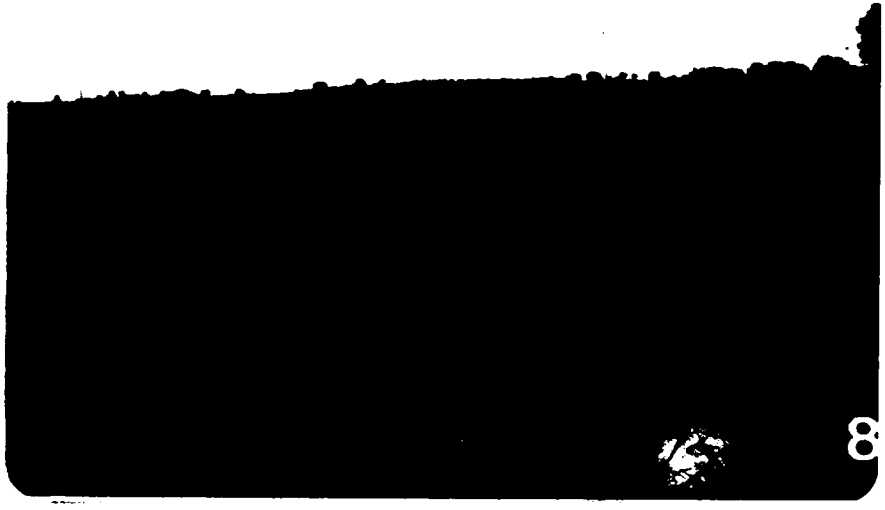
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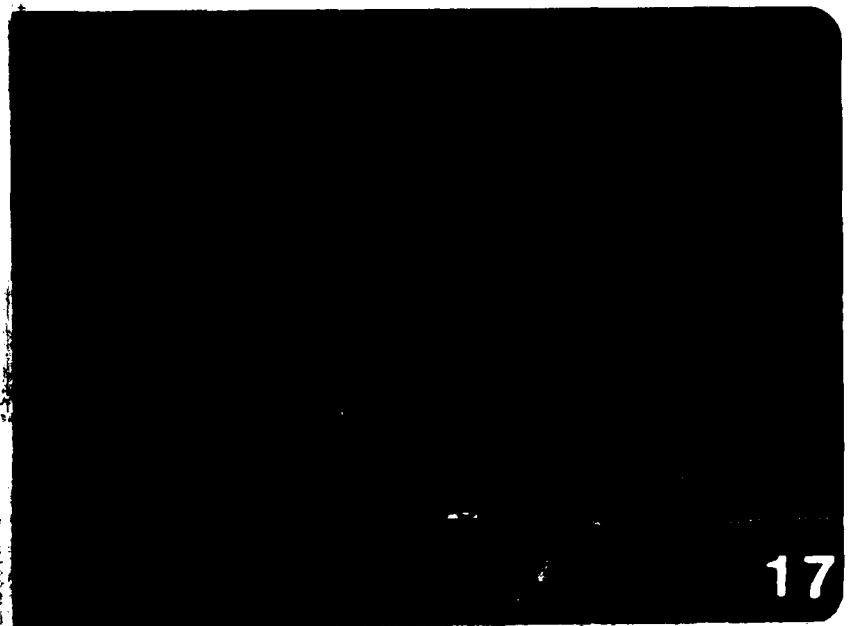
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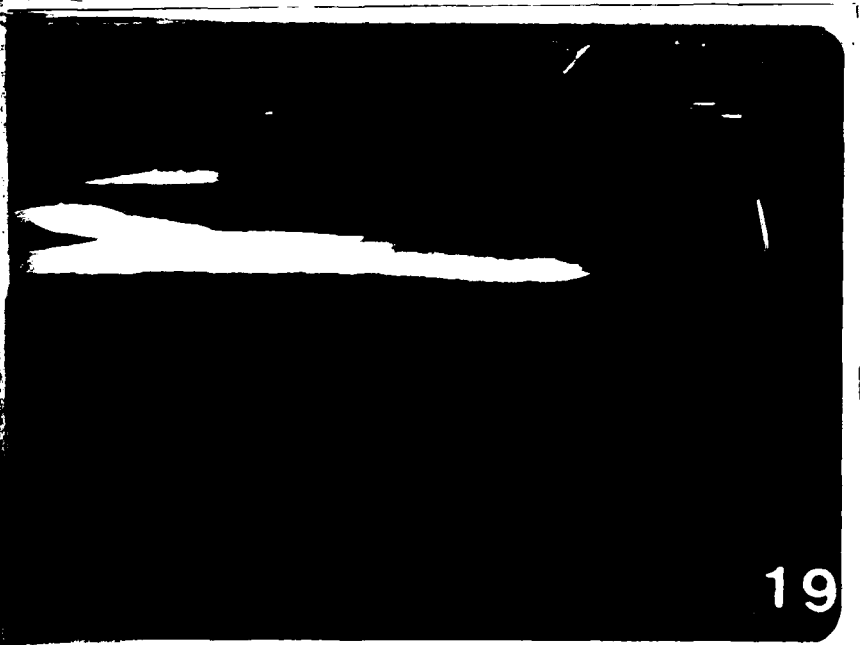
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DATE
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